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10

Unavoidable Adverse Impacts;  
Short-Term Uses and Long-Term  
Productivity; and Irreversible or  
Irretrievable Commitment of  
Resources

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## **10. UNAVOIDABLE ADVERSE IMPACTS; SHORT-TERM USES AND LONG-TERM PRODUCTIVITY; AND IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES**

This chapter discusses adverse impacts that would remain after the application of mitigation measures (see Chapter 9). It analyzes the relationship between short-term uses of the human environment and the maintenance and enhancement of long-term productivity, and it identifies irreversible or irretrievable commitments of resources. The chapter presents information drawn from the analysis of the Proposed Action. It summarizes and consolidates information from the impact and mitigation analyses in Chapters 4, 5, 6, and 9, and provides references to earlier chapters for readers who require more detailed information.

The chapter discusses only resource areas for which preceding analyses have identified unavoidable impacts. Nevertheless, the discussions in Sections 10.1, 10.2, and 10.3 reflect an examination of the resource areas analyzed in this EIS.

The construction, operation and monitoring, and eventual closure of the proposed Yucca Mountain Repository and the associated transportation of spent nuclear fuel and high-level radioactive waste would have the potential to produce some environmental impacts that the U.S. Department of Energy (DOE) could not mitigate. Similarly, some aspects of the Proposed Action could affect the long-term productivity of the environment or would require the permanent use of some resources.

### **10.1 Unavoidable Adverse Impacts**

This section summarizes potential impacts associated with the proposed repository and transportation actions that would be unavoidable and adverse and that would remain after DOE implemented mitigation measures. Chapter 9 discusses mitigation measures. This chapter mentions some but not all mitigation measures. Some aspects and activities discussed in Section 10.1 are analyzed from different perspectives in Sections 10.2 and 10.3.

#### **10.1.1 YUCCA MOUNTAIN REPOSITORY**

This section summarizes unavoidable adverse impacts associated with the construction, operation and monitoring, closure, and long-term performance of the proposed repository.

##### **10.1.1.1 Land Use**

To develop the proposed Yucca Mountain Repository, DOE would need to obtain permanent control of land surrounding the Yucca Mountain site. DOE could obtain permanent control over the land only if Congress completed a land withdrawal action. A Congressional withdrawal would include lands already withdrawn for the Nevada Test Site and Nellis Air Force Range as well as lands under the control of the Bureau of Land Management and not currently withdrawn.

In general, the permanent withdrawal of land for the repository would prevent human use of the withdrawn lands for other purposes. Nevada Test Site activities would continue on a noninterference basis unless the Congressional land withdrawal specifically precluded them. Because the Yucca Mountain site has a low present resource value, is remote, and is partly withdrawn, the resultant impact would be small.

The disposal of spent nuclear fuel and high-level radioactive waste could permanently affect the availability of the surface and subsurface of the Yucca Mountain site. The Chapter 4 land-use discussion includes the availability of the land and the consequences of withdrawal.

#### **10.1.1.2 Air Quality**

Construction, operation and monitoring, and closure of a repository at Yucca Mountain would produce very small impacts to regional air quality. Radiological impacts could occur from the release of radionuclides. The principal radionuclides released from the subsurface would be naturally occurring radon-222 and its decay products in ventilation exhaust air. There are no applicable regulatory limits for radon releases from Yucca Mountain facilities. Other impacts would come from criteria pollutants and materials such as cristobalite and erionite. Exposures of maximally exposed individuals to radionuclides and criteria pollutants would be a small fraction of applicable regulatory limits.

#### **10.1.1.3 Hydrology**

Construction activities would temporarily restrict and minimally alter natural surface-water drainage channels. Facilities and roadways would be designed to withstand at least a 100-year flood. Therefore, after construction was complete, only flow from infrequent more intense floods would affect those facilities and roadways. Ground-disturbing activities and the surface facilities that DOE would build would alter surface-water infiltration and runoff rates in localized areas. Given the relatively small size of the affected land in comparison to the total drainage area, drainage channels and washes would experience little difference in impacts as a result of the disturbances. DOE estimates that overall consequences from the construction of roadways and facilities would be minimal. Appendix L contains a floodplain/wetlands assessment that examines the effects of branch rail line and highway route construction, operation, and maintenance on floodplains in the vicinity of Yucca Mountain.

There would be withdrawals of groundwater during construction, operations and monitoring, and closure, but they would not exceed estimates of perennial yield. Chapter 4, Section 4.1.3, provides details on the effects of repository construction, operation and monitoring, and closure on hydrology.

In the reference design, waste packages would be placed about 300 meters (1,000 feet) below the mountain surface and about 300 meters above the water table (see Section 5.2). Even if future climates were much wetter than they are today, the mountain would not be likely to erode and leave the waste exposed, and the water table would not be likely to rise high enough to reach the waste.

In the current semiarid climate, about 18 centimeters (7 inches) of water a year from rain and snow fall on Yucca Mountain. Nearly all of that precipitation, about 95 percent, runs off or evaporates. Only about 0.65 centimeter (0.31 inch) of water per year moves down (or percolates) through the nearly 300 meters (1,000 feet) of rock to reach the proposed level of the repository (see Chapter 3, Section 3.1.4).

After waste packages were placed in the repository, the heat generated from radioactive decay would raise the temperature in the drifts above the boiling point of water. The heat should dry the surrounding rock and drive any water away for hundreds to thousands of years. However, as the waste decayed and the repository cooled, some water would begin to seep through fractures in the rock into the drifts and pass through the repository.

Analysts estimate that, after the repository cooled enough, about 5 percent of the packages could experience dripping water under the current climate. If the climate changed to a wetter long-term average, about 30 percent of the packages could experience dripping water. Based on preliminary results of corrosion experiments and the opinions of experts, computer simulations indicated that most waste

packages would last more than 10,000 years, even if water was dripping on them. The longevity of manmade materials in the repository environment over such long periods is subject to considerable uncertainty, however, and some waste packages could fail earlier. Analysts estimated that dripping water could cause the first penetrations—tiny pinholes—to appear in some waste packages after about 4,000 years. More substantial penetrations could begin to occur about 10,000 years later. Analysts also assumed that at least one waste package would fail within 1,000 years due to a manufacturing defect (see Chapter 5, Section 5.4.1).

After water entered a waste package, it would have to penetrate the metal cladding of the spent nuclear fuel to reach the waste. For about 99 percent of the commercial spent nuclear fuel, the cladding is highly corrosion-resistant metal designed to withstand the extreme temperature and radiation environment in the core of an operating nuclear reactor. Current models indicate that it would take thousands of years to corrode cladding sufficiently to allow water to reach the waste and begin to dissolve the radionuclides.

During the thousands of years required for water to reach the waste, the radioactivity of most of the radionuclides would decay to virtually zero. For the remaining radionuclides to get out of the waste package, they would have to dissolve in the water. Few of the remaining radionuclides could dissolve at a meaningful rate. Thus, only long-lived water-soluble radionuclides could get out of the waste package. Long-lived water-soluble radionuclides that migrated from the waste packages would have to move down through about 300 meters (1,000 feet) of rock to the water table and then travel about 20 kilometers (12 miles) to reach a point where they could be taken up in a well and consumed or used to irrigate crops (see Chapter 5, Sections 5.3 and 5.4).

As the long-lived water-soluble radionuclides began to move down through the rock, some would stick (or adsorb) to the minerals in the rock and be delayed in reaching the water table. After reaching the water table, radionuclides would disperse to some extent in the larger volume of groundwater beneath Yucca Mountain, and the concentrations would be diluted. Eventually, groundwater with varying concentrations of different radionuclides would reach locations in the hydrologic (groundwater) region of influence where the water could be consumed.

Of the approximately 200 different radioactive isotopes present in spent nuclear fuel and high-level radioactive waste, nine are present in sufficient quantities and are sufficiently long-lived, soluble, mobile, and hazardous to contribute meaningfully to calculated radiation exposures.

#### **10.1.1.4 Biological Resources and Soils**

Unavoidable adverse impacts to biological resources would include the loss of small pieces of habitat totaling less than 2 square kilometers (500 acres). The pieces that would be disturbed are habitat for terrestrial plant and animal species that are widespread throughout the region and typical of the Mojave and Great Basin Deserts. The death or displacement of individuals of some animal species as a result of site clearing and vehicle traffic would be unavoidable; however, changes in the regional population of any species would be minimal and largely undetectable.

No endangered species are found on the site. The only threatened species on the site is the desert tortoise (see Chapter 4, Section 4.1.4). Approximately 2 square kilometers (500 acres) of desert tortoise habitat would be lost. This habitat is at the northern end of the range of the desert tortoise and is not designated critical habitat for the tortoise. The quantity of habitat that could be lost would be minimal in comparison to the range of the desert tortoise. Individual tortoises could be killed inadvertently during site clearing and by vehicle traffic. Preconstruction surveys, relocation of affected individuals, and general adherence to conditions developed in the course of endangered species consultations would minimize, but not prevent, such deaths. Chapter 4, Section 4.1.4, discusses in detail the potential for loss of habitat or the

deaths of individual members of this species. Chapter 9 (Sections 9.2.3 and 9.3.4) discusses mitigation measures to reduce potential impacts to the desert tortoise, including measures to locate facilities and roadways to avoid sensitive areas and measures to protect tortoises from construction impacts.

#### **10.1.1.5 Cultural Resources**

In the view of Native Americans, the implementation of the proposed repository and its facilities would further degrade the environmental setting. Even after closure and reclamation, the presence of the repository would, from the perspective of Native Americans, represent an irreversible impact to traditional lands.

Some unavoidable adverse impacts could occur to archaeological sites and other cultural resources, although no such sites or culturally important artifacts have been found at the site of the proposed repository. There could be a loss of archaeological information due to illicit artifact collection. In addition, excavation activities could cause a loss of archaeological information. Chapter 3, Section 3.1.6, discusses the program DOE has in place to address and mitigate cultural resource impacts and issues. DOE anticipates this program would continue through repository closure.

##### **NATIVE AMERICAN VIEW**

A Native American view of facility and transportation route development, especially in remote areas such as Yucca Mountain and its surroundings, as expressed in the *American Indian Perspectives on the Yucca Mountain Site Characterization Project and the Repository Environmental Impact Statement* (AIWS 1998, pages 2-20 and 3-1), is that development of such facilities and routes inherently degrades the entire environment. This view is based on the concept that the earth, its waters, the air, and the sky are a whole and have a sacred integrity in their natural form. Chapter 4, Section 4.1.13, of this EIS presents an environmental justice discussion of this Native American perspective.

#### **10.1.1.6 Occupational and Public Health and Safety**

There would be a potential for injuries to or fatalities of workers from facility construction, including accidents and inhalation of cristobalite. Cristobalite is a naturally occurring hazardous material in the rock of Yucca Mountain. Engineering controls and training and safety programs would reduce but not eliminate the potential for injuries or fatalities to workers.

Short-term impacts during the operation and monitoring phase would present a potential for injuries or fatalities to workers from industrial accidents and exposure to radioactive materials. Engineering controls and training and safety programs would reduce but not eliminate the potential. There would also be a potential for injuries and fatalities during closure. The occupational and public health and safety discussion in Chapter 4 (Sections 4.1.7 and 4.1.8) provides details on the potential for worker injuries and fatalities. The potential for injury or death to members of the public from exposure to radioactive materials or industrial activity would be extremely small.

While there would be a potential for radioactive contamination of groundwater during the 10,000-year analysis period from materials stored at the proposed repository, there would be only a small potential for such contamination to produce long-term adverse health impacts in the surrounding region during this period. Potential long-term impacts to human health from the repository in the far future would be dominated by impacts from radioactive materials dissolved or suspended in water pathways. The dose to the maximally exposed individual would depend on the distance from the repository and the uses made of the land and waters.

At the closest distance evaluated [5 kilometers (3 miles)], the highest 95th-percentile annual dose to the maximally exposed individual for the 10,000-year analysis period could be 1.3 millirem per year. The highest chance of a latent cancer fatality to this hypothetical individual would be 4.4 in 100,000 (see Chapter 5, Section 5.4.1). A latent cancer fatality is a cancer fatality that could occur after and as a result of exposure to radionuclides from the repository and that would be in addition to cancer fatalities occurring from all other causes.

Expected doses and consequences to the population from exposure to radionuclides transported by groundwater from the repository were forecast for the 10,000-year analysis period. The 95th-percentile population dose over the 10,000-year period could be 0.032 person-rem over an assumed 70-year lifetime. The estimated 95th-percentile chance that a single latent cancer fatality could occur in the population during any 70-year lifetime would be 1.6 in 100,000. Over the 10,000-year analysis period, the estimated chance that a latent cancer fatality could occur would be 5.3 in 10,000 (see Chapter 5, Section 5.4.1). These consequences would be small.

DOE estimates that most waste packages would remain intact longer than 10,000 years. Current model simulations forecast that some packages would last more than 1 million years. The highest 95th-percentile peak annual dose rate to a hypothetical maximally exposed individual could be 9,100 millirem per year approximately 320,000 years in the future. The highest mean peak annual dose rate to a maximally exposed individual could be 1,400 millirem per year approximately 792,000 years in the future (see Chapter 5, Section 5.4).

There would also be a potential that chromium releases could produce estimated peak concentrations during the first 10,000 years of 0.037 milligram per liter at 5 kilometers (3 miles) (95th-percentile probability). This value is about one-third of the threshold for contamination in drinking water.

### **10.1.2 NEVADA TRANSPORTATION ACTIONS**

This section summarizes unavoidable adverse impacts associated with the transportation of spent nuclear fuel and high-level radioactive waste and with the construction and operation of transportation facilities and routes in Nevada. Chapter 6 (Sections 6.1.2 and 6.3) provides more detailed discussions.

#### **10.1.2.1 Land Use**

Constructing and operating a new branch rail line would result in unavoidable changes to present land uses and control of the lands affected directly. The range of potentially affected uses includes grazing, wildlife habitat and management areas, utility corridors, lands leased for oil and gas development, and military lands. Present uses of adjoining lands would be affected only minimally. Each of the five alternative rail alignments encompasses a range of different land uses and surface features. If the choice was to construct a new branch rail line, the selection of a specific corridor would determine the land actually taken and the extent of impacts to land uses along that corridor. Land disturbed for a specific corridor implementing alternative could vary from 5 to 19 square kilometers (1.9 to 7.3 square miles). Most land along the corridors under consideration is government-owned.

Routes for heavy-haul or legal-weight trucks would follow existing highways and would require little additional land disturbance. Building and operating an intermodal transfer station would result in unavoidable changes of land use and ownership. The land for an intermodal transfer station could be public or private. Actual land uses lost would depend on the site selected. DOE expects that the total land disturbance for any implementing alternative for the construction of an intermodal transfer station and construction along existing highways would be 0.2 square kilometer (about 50 acres). For heavy-haul truck routes originating at Caliente, an additional 0.04 square kilometer (10 acres) could be required for a

mid-route stop. For the Caliente heavy-haul truck route only. A further 0.04 square kilometer could be required for the construction of a highway segment near Beatty, Nevada.

In some instances transportation facilities could remain in place to serve other purposes after DOE had ended use. Similarly, affected land could revert to other uses after the end of transportation activities and the removal of facilities.

#### **10.1.2.2 Hydrology**

The construction of a branch rail line or the upgrading of roads to accommodate heavy-haul transportation in Nevada would involve the unavoidable adverse impact of altering natural surface-water drainage patterns. Any of the Nevada transportation corridors would cross a number of natural drainage channels. Upgrade activities for a route to be used by heavy-haul trucks would involve the extension of existing drainage control structures as necessary to support the road upgrades. In this case, there would be minor changes to drainage channels already altered to some extent by the original road construction. The construction of a branch rail line would require alterations to many natural drainage areas along the line. Bridges and culverts would be used as necessary to cross streams, creeks, or, most predominantly, washes of any size. These structures would be built to accommodate a 100-year flow in the channels; the resulting drainage alteration would be confined to relatively small areas. Construction could alter small drainage channels or washes more because the railway design could call for the collection of some channels to a single culvert. At the end of the period during which DOE would transport spent nuclear fuel and high-level radioactive waste to the repository, the Department could remove facilities built for transportation and land recovery could begin, or it could use the facilities for other purposes. Appendix L contains a floodplain/wetlands assessment that presents a comparison of what is known about the floodplains, springs, and riparian areas along the five alternative rail routes and at the three alternative intermodal transfer station sites with their five associated heavy-haul routes.

#### **10.1.2.3 Biological Resources and Soils**

Unavoidable adverse impacts to biological resources from transportation in Nevada could occur as a result of habitat loss and the deaths of small numbers of individual members of the species along transportation routes. Habitat loss would be associated with the construction of either a new rail line or an intermodal transfer station and upgrades to existing highways. This loss would occur in widely distributed land cover types, and would include the loss of a small amount of desert tortoise habitat and the deaths of a small number of tortoises. The deaths of individual members of a species as a result of construction activities or from vehicle traffic would be unlikely to produce detectable changes in the regional population of a species.

Transportation route construction or upgrades would subject disturbed soils to increased erosion for at least some of the construction phase. The recovery of these disturbed areas to predisturbance conditions would occur with the passage of time. Transportation facilities such as a branch rail line could be used for nonrepository-related purposes, potentially extending their useful life beyond the period needed for the Proposed Action. The removal of transportation facilities after the end of their useful life would assist habitat recovery.

#### **10.1.2.4 Cultural Resources**

Some unavoidable impacts could occur to archaeological sites and other resources as a result of the construction of a rail line or the upgrade of a highway to heavy-haul capability. The potential for impacts to specific resources cannot be identified before final surveys and actual construction. An agreement now in effect between DOE and the Advisory Council on Historic Preservation for repository site



characterization could serve as a model for an agreement to protect archaeological sites and other resources along transportation corridors. In addition, a number of statutes provide protective frameworks (see Chapter 11). Nevertheless, there would be a potential for grading and other construction activities to degrade, cause the removal of, or alter the setting of archaeological sites or other cultural resources. Although mitigated to some extent by worker education programs, there could be some loss of archaeological information due to the illicit collection of artifacts. In addition, excavation activities could cause loss of archaeological information.

### 10.1.2.5 Occupational and Public Health and Safety

Certain adverse impacts to workers and the public from the construction and operation of the rail and heavy-haul implementing alternatives would be unavoidable. Table 10-1 presents potential impacts to worker health during construction and the potential for traffic fatalities among the implementing alternatives during operations.

**Table 10-1.** Unavoidable adverse impacts from rail and heavy-haul truck implementing alternatives.<sup>a</sup>

| Implementing alternative | Construction (worker injuries and illnesses) | Operation (traffic fatalities) |
|--------------------------|--|--------------------------------|
| <i>Rail</i>              |  |                                |
| Caliente                 | 110  | 0.83                           |
| Carlin                   | 100  | 0.85                           |
| Caliente-Chalk Mountain  | 80   | 0.81                           |
| Jean                     | 68   | 0.61                           |
| Valley Modified          | 32   | 0.60                           |
| <i>Heavy-haul truck</i>  |  |                                |
| Caliente                 | 32   | 2.7                            |
| Caliente-Chalk Mountain  | 19   | 2.2                            |
| Caliente-Las Vegas       | 22   | 2.5                            |
| Apex/Dry Lake            | 13   | 1.5                            |
| Sloan/Jean               | 14   | 1.6                            |

a. Source: Chapter 6, Sections 6.3.2.1 and 6.3.3.1.

The transportation of spent nuclear fuel and high-level radioactive waste would have the potential to affect workers and the public through exposure to radiation and vehicle emissions and through traffic accidents. This EIS evaluates two transportation scenarios—one in which DOE would transport the materials mostly by truck and the other in which it would transport the materials mostly by rail. DOE estimates that the transportation of spent nuclear fuel and high-level radioactive waste in the mostly truck scenario could cause approximately 23 latent cancer fatalities among workers and the public as a result of exposure to radiation and emissions over the course of 24 years. Over the same period, DOE estimates that transportation mostly by rail could cause approximately 4 latent cancer fatalities among workers and the public. In addition, DOE estimates that transportation mostly by truck or mostly by rail could result in approximately 3.9 or 3.7 traffic fatalities, respectively (see Chapter 6, Section 6.2.4.2).

## 10.2 Relationship Between Short-Term Uses and Long-Term Productivity

The Proposed Action could require short-term uses of the environment that would affect long-term environmental productivity. This section describes possible consequences to long-term productivity from those short-term environmental uses.

The EIS analysis identified two distinct periods for the evaluation of the use of the environment by the Proposed Action:

- A 120- to more than 300-year period for surface activities consisting of construction, operation and monitoring, and closure of the proposed repository. DOE activities during this period would include construction of facilities, receipt and emplacement of spent nuclear fuel and high-level radioactive waste, recovery of recyclable materials, decontamination, closure of surface and subsurface facilities, reclamation of land, and long-term monitoring. Sections 10.1.1.1 through 10.1.1.6 describe the unavoidable impacts that could occur during this period. This period would be the only time during which DOE would actively use the affected lands and the only time during which activities would involve the surface of the land used for the repository.
- The balance of a 10,000-year period would be for the evaluation of consequences from the disposal of spent nuclear fuel and high-level radioactive waste.

In general, transportation and disposal activities associated with the proposed repository would benefit long-term productivity by removing spent nuclear fuel and high-level radioactive waste from 72 commercial and 5 DOE sites around the country. In addition, removing these materials from existing sites would also free people and resources committed—now and in the future—to monitoring and safeguarding these materials for other potentially more productive activities. Removal could create conditions that would enable the initiation of other productive uses at the commercial and DOE sites. Finally, disposing of spent nuclear fuel and high-level radioactive waste in the proposed repository would provide a long-term global benefit by isolating the materials from concentrations of human population and human activity, thereby reducing the potential for sabotage.

### **10.2.1 YUCCA MOUNTAIN REPOSITORY**

This section summarizes the relationship between short-term uses of land and resources and long-term land and resource productivity for the construction, operation and monitoring, closure, and long-term performance of the proposed repository. The terms “short-term” and “long-term” commonly used in National Environmental Policy Act analyses do not have a consistent duration in this section. For the analysis of impacts associated with repository activities, *short-term* refers to the time from the start of construction to the end of relevant surface and subsurface human activity, which DOE anticipates to be a 120- to 300-year period. *Long-term* refers to the time between the end of relevant surface and subsurface human activity and the time when environmental resources have recovered from the potential for impacts and are again productive, or a maximum of 10,000 years. For transportation, *short-term* refers to the time of construction or actual transportation, as appropriate. *Long-term* refers to the time from the end of the short-term period to the time of environmental recovery. *Productivity* refers to the ability of an element of the environment to generate crops, provide habitat, or otherwise serve as a medium for the creation of value.

#### **10.2.1.1 Land Use**

From the start of construction through the 10,000-year period, the construction, operation and monitoring, and closure of the proposed repository would deny other users the use of the Yucca Mountain vicinity for other purposes. Chapter 4, Section 4.1.1, discusses the long-term uses of land. Conversely, a repository at Yucca Mountain would enable consideration of other uses for the sites where spent nuclear fuel and high-level radioactive waste are being stored and the land buffering those sites. Many present storage sites are in locations that would permit a wider range of alternative uses than does Yucca Mountain.

### **10.2.1.2 Hydrology**

The proposed repository would be in a terminal basin that is hydrologically isolated and separated from other bodies of surface and subsurface water; that is, once water enters the basin it can leave only by evapotranspiration. As noted in Section 10.1.1.3, there would be a potential for materials disposed of at the proposed Yucca Mountain Repository to reach groundwater at some time between several thousand years and several hundred thousand years. If such contamination reached groundwater in the accessible environment, and if the groundwater contamination exceeded applicable regulatory requirements, there could be an attendant loss of productivity for the affected groundwater and for surface waters in the basin that the groundwater supplied. Conversely, the disposal of spent nuclear fuel and high-level radioactive waste at Yucca Mountain would free a wide range of major and minor water bodies throughout the United States from the potential threat of radioactive contamination from the materials at the present storage sites.

### **10.2.1.3 Biological Resources and Soils**

Short-term uses that could cause impacts to biological resources and soils would be associated with the construction, operation and monitoring, and closure of the repository; those activities could lead to long-term productivity loss in disturbed areas. This loss would be limited to less than 2 square kilometers (500 acres) of widely distributed habitats adjacent to existing disturbed areas. Biological resources would be affected directly by land disturbances. The overall impact to populations of species would be limited because the area disturbed and the number of individual animals lost would be small in relation to the regional availability.

Long-term productivity loss for soils would be limited to areas affected by land disturbances. These areas would be revegetated after the completion of closure activities. Revegetation would be accomplished through the reclamation of disturbed sites using surface soils stockpiled during construction, reseeded, and similar activities that would enhance recovery. Chapter 4, Section 4.1.4, contains more detail on productivity losses and reclamation. The disposal of spent nuclear fuel and high-level radioactive waste at Yucca Mountain would remove these materials from proximity to biota near the present storage sites across the United States.

### **10.2.1.4 Occupational and Public Health and Safety**

A repository at Yucca Mountain would be likely to have a positive effect on the nationwide general occupational and public health because of the cessation of doses to workers at the present storage sites and because the spent nuclear fuel and high-level radioactive waste would be substantially more isolated from concentrations of people and from pathways to concentrations of people.

## **10.2.2 TRANSPORTATION ACTIONS**

The construction of a rail line or an intermodal transfer station and improvements to existing highways, all short-term uses, could lead to a long-term loss of productivity in disturbed areas along the routes. In the context of transportation, *long-term* refers to the period of environmental recovery after the end of the construction period or the active use of a transportation route for repository purposes. A route could be used for repository purposes from 10 to approximately 30 years.

The land cover types along any route are widely distributed in the region. A loss of vegetation from a disturbed area along a route would have little effect on the regional productivity of plants and animals.

Productivity loss for soils would be limited to areas affected by land clearing and construction. These areas would not be available for revegetation and habitat for some time. Disturbed areas would recover, however, and eventually would return to predisturbance conditions, although the process of recovery would be slow in the arid environment. Chapter 6 contains more data on transportation.

The construction of a rail line, if the line were also used for nonrepository uses, could result in productivity benefits for Nevada by increasing transportation opportunities, lowering transportation costs, reducing accidents, and lowering nitrogen oxides, carbon monoxide, and other gaseous criteria pollutant emissions by diverting transportation from highway to rail.

The major long-term consequence of transporting spent nuclear fuel and high-level radioactive waste to the repository would be the permanent consolidation of these materials in an isolated location away from concentrations of people and without exposure pathways to concentrations of people.

### **10.3 Irreversible or Irretrievable Commitment of Resources**

The Proposed Action would involve the irreversible or irretrievable commitment of land, energy, and materials. The commitment of a resource is irreversible if its primary or secondary impacts limit future options for the resource. An irretrievable commitment refers to the use or consumption of resources that are neither renewable nor recoverable for later use by future generations. Construction, operation and monitoring, and eventual closure of a repository at Yucca Mountain would result in a permanent commitment of land, groundwater, surface, subsurface, mineral, biological, soil, and air resources; materials such as steel and concrete; and consume energy in forms such as gasoline, diesel fuel, and electricity. Water use would support construction, operation and monitoring, and closure actions, and options for using groundwater could become limited if there was contamination from radionuclides. There would be an irreversible and irretrievable commitment of associated natural resource services such as uses of land and habitat productivity.

#### **10.3.1 YUCCA MOUNTAIN REPOSITORY**

The construction, operation and monitoring, closure, and long-term performance of the Yucca Mountain Repository would result in the permanent commitment of the surface and subsurface of Yucca Mountain and the permanent withdrawal of lands from public use. Because of the remote location of Yucca Mountain, the lack of present uses of the land, the terminal and isolated nature of the water basin, and the limited amounts of materials and energy required for the repository in comparison to the supply capability of the regional and national economies, the irreversible and irretrievable commitments of resources for repository-related activities would be small.

Mitigation approaches that would involve the excavation of archaeological sites to prevent degradation by construction activities would destroy the contexts of those sites and reduce the finite number of such resources in the region. DOE expects that its activities at the proposed repository would affect no more than a minimal number of such sites. The Department would use state-of-the-art mitigation techniques on the Yucca Mountain Project.

Electric power, fossil fuels, and construction materials would be irreversibly committed to the project. Most of the steel used for the surface facilities would be recyclable and, therefore, not an irreversible or irretrievable commitment. Some copper and steel in the ramps and access mains to subsurface facilities would be recyclable, while some in the emplacement drifts would be irreversibly and irretrievably lost. Some steel, such as rebar, would be difficult to recycle. The quantity of resources consumed would be small in comparison to their national consumption or their availability to consumers in southern Nevada.

These quantities are described in Chapter 4. To the extent that there is value in spent nuclear fuel or high-level radioactive waste, that value would be committed to the repository.

Aggregate would be crushed as required and mixed in concrete for the cast-in-place and precast concrete structures and liners that would be used in the repository. The amount of sand and aggregate could range from 500,000 to 1.5 million metric tons (550,000 to 1.7 million tons). If Yucca Mountain tuff was used, the amount crushed and used as sand and aggregate would be about 10 percent of the total excavated from the drifts (see Chapter 4, Section 4.1.11).

### **10.3.2 TRANSPORTATION ACTIONS**

The construction of a rail line or an intermodal transfer station would result in an irretrievable but not irreversible commitment of resources. Many resources could be retrieved at a later date through such actions as removing roadbeds, revegetating land, and recycling materials. Land uses would change along the selected transportation corridor during repository construction, operation and monitoring, and closure, thereby limiting or eliminating other land uses for that period. At the end of that period, however, land along the corridor could revert to public or private ownership.

Mitigation approaches involving the recovery of archaeological resources before construction activities degraded the sites would reduce the finite number of such resources in the Yucca Mountain region and destroy the context of sites. DOE would use state-of-the-art mitigation techniques during the construction of a rail corridor or an intermodal transfer station or the modification of roadways to accommodate heavy-haul trucks. Heavy-haul construction would be likely to generate only minimal impacts to cultural resources because construction would largely involve modifications to existing roads.

DOE would use about 500 to 700 million liters (132 to 185 million gallons) of fossil fuel from the nationwide supply system to transport spent nuclear fuel and high-level radioactive waste to the repository. The analysis in Chapter 6 (Sections 6.1.2.10, 6.3, 6.3.2.1, 6.3.2.2, 6.3.3.1, and 6.3.3.2), evaluates fuel use for the different transportation scenarios. The amount used would be a very small fraction of a percent of the Nation's supply over the period of fuel use.

The manufacture of casks and containers would require commitment of aluminum, chromium, copper, depleted uranium, lead, molybdenum, nickel, and steel. The required amounts of these materials, expressed as percentages of U.S. production, would be low with the exception of nickel, which would require approximately 8.2 percent of annual U.S. production.